"CABIN & FIRE SAFETY A PERSPECTIVE FROM THE COCKPIT" NOVEMBER 17TH, 1998

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INTRODUCTION

The Air Line Pilots Association represents more than 50,000 commercial airline pilots in the US and Canada, at 50 airlines. Our organization has been involved in aircraft design and operation since its inception. "Schedule with Safety" is the motto of our Association members and the commitment to that motto is demonstrated by the millions of safe hours flown by our members yearly in an ever-increasing complex environment.

We desire to work cooperatively to improve aviation safety for all and will continue to strive for safety improvements as the lives of our passengers and crews depend on it. Our organization is involved in all areas of aircraft safety and the ALPA Accident Survival Committee has a number of projects relevant to aircraft cabin and fire safety. The following are short summaries of them.

CARGO TEMPERATURE TREND INDICATORS (TTI)

The May 11, 1996 accident of Valujet 592 in the Florida Everglades served as the launching point for our activity on this project. That accident resulted in the FAA decision to require both detection and suppression systems in almost all cargo compartments. Specifically, it required that airlines convert their Class D compartments that depend on fire containment by limiting the available oxygen via a tight compartment liner into Class C compartments that have both detection systems and extinguishment systems. The pilots need better and more reliable information about the cargo compartment status. Since we as pilots do not have the ability to examine the area reporting the fire condition, as do most other commercial applications, it is imperative that we have this feature. Since it is the heat that presents the greatest threat to the pilot and the continued safety of the flight, we must have this information. It is not the intention of any pilot to ignore any smoke alarm without the presence of heat, but the real time temperature readout offers the following additional advantages:

A.-- The fire growth rate can be monitored so that the pilot can continually evaluate his options. A fast flaming fire may change the definition of the "most suitable" airport found in all Part 121 emergency routines. It may be necessary for the aircraft to land at a smaller airport without firefighting equipment or security personnel, if the pilot sees a fast developing fire which poses an immediate threat to his aircraft, and an immediate evacuation is necessary. On the other hand, if the fire is a slow smoldering fire which can be verified with the use of a very reliable temperature readout, then the pilot may wish to continue to an airport where a safer evacuation can be made with the added help of ground firefighting and security personnel.

 B.-- Following the discharge of a halon fire suppression system, it is not possible for the pilot to determine the status of the fire. Since most cargo areas are "air tight" the smoke alarm equipment will continue to report an alarm condition even if the fire is extinguished and safe. Only after the aircraft is on the ground, will the smoke completely clear from the cargo areas, after the doors are opened and fresh air is allowed to enter. For the remainder of the flight, following the fire suppression discharge, the pilot has no idea if the fire has been extinguished, checked, or continues to grow.

C.-- It is only a matter of time until the pilot of a large overwater-transport aircraft will be forced to make the most difficult decision concerning the safety of his aircraft. With many of the ETOPS alternates being eliminated, a smoke detector alarm could pose a difficult decision for the pilot. He may be forced to make the decision to continue the flight with a smoke alarm constantly lit or to exercise a "ditching operation." Without the help of real time temperature monitoring this becomes an agonizing decision. The decision to continue the flight to the nearest safe airport, knowing that the halon system has contained the fire and the temperature has subsided would certainly be preferable over a mid-pacific ditching exercise.

Recently we have been encouraged by the work of the FAA and National Institute of Science and Technology (NIST) to explore different technologies in the fire and smoke detection technologies. However, we must emphasize that the aircraft industry is already behind the commercial industry when it comes to detection technology. The following type of detection is currently in use and standard in many commercial applications.

A.-- ALARM VERIFICATION TECHNOLOGY. This type of detection has a delay time of 5 to 30 seconds in which the signal is held and the detector is reset. If the detector still senses smoke for a period of time after the delay-reset, then the signal is transmitted as an alarm. This technology is presently in place and has proven very effective in preventing false alarms.

B.-- SMART DETECTOR TECHNOLOGY. This type of detection uses control panel surveillance of the remote detector to determine when the detector is out of tolerance and is subject to false alarms. Again, these systems are in use commercially and have greatly reduced the false alarm rate.

C.-- COMBINATION TYPE DETECTORS. In commercial applications where false alarms are very costly, combination type detectors which use more than one physical criteria before announcing an alarm are commonplace.

It must be emphasized that this technology is in place because of the initial failure of the detection industry to produce a reliable detector. Only after protest from the industry and fire departments in the late 70's and early 80's did the improvement in detector technology substantially reduce the false alarm occurrences. The aircraft industry is presently at the stage where commercial buildings were 20 years ago. That is, with the high false alarm rate presently occurring in the aircraft industry, pilots may soon lose confidence in the system just as commercial users did some 20 years ago. According to Richard Bukowski in a recent article in the NFPA journal titled "FALSE ALARMS?", "airforce pilots sick of false alarms have disconnected the detectors." According to Bukowski, 55% of all real in-flight fires went undetected because these detectors were disconnected.

Since the technology generated by the commercial industry in the late 70's is here and inplace we see very little reason for history to repeat itself. We recommend that the FAA set high standards for manufacturers to produce a reliable detector with minimal false alarms.

The decision that a pilot must make upon getting a fire indication is not as clear cut as some might believe. The decision will vary depending on the fire intensity, but only if the pilot knows that. The decision will affect the pilot's choice of what airport is a *suitable* choice, and it will help the pilot in understanding the problem. A TTI will help the pilot monitor the fire's growth. TTI's will help the pilot make the best and most appropriate decision, which can affect the safety of all the passengers. Fire growth is not linear, and the diversion decision may vary depending on the fire status. Ditching may be the best alternative.

In fact, we find that we may need similar indicators for more compartments in the airplane, such as the EE, cargo, attic, and APU, just like a body's nervous system. The problem in the past has been in false alarms. That is still a problem with today's technology that is being installed in reaction to the Valujet accident. But appropriate technology can fix these issues. The current false alarm rate is 160 false alarms for each alarm that is genuine.

Industries where fire can be devastating, such as the computer chip manufacturing, have very sophisticated fire detection systems. Yet they are equally impacted by false alarms. Thus, they have developed systems appropriate for their situations that are both reliable and unflappable. Airliners are in similar situation, as they are isolated at high altitude and loss of systems due to fire can disable the airplane and make it uncontrollable. This should make it clear why we demand such a high standard for our fire detection systems. This can be achieved with diligent effort. Our view is that TTI is a simple and effective first step.

CREW PROTECTIVE BREATHING AND VISION EQUIPMENT (CPBVE)

Crew protection is second only to maintaining integrity of the airplane systems in order to save passenger lives. The Valujet 592 accident clearly confirmed this. In another accident involving a cargo operator, the airplane was successfully landed before the fire disabled the aircraft or crew. However, the crew found the protective goggles very cumbersome and ineffective. In fact, the crew discarded the goggles as the crew found they interfered with their glasses. This has led us to conclude that the approval process for crew PBE is lacking. The FAA should rewrite the standards for CPBVE to evaluate the equipment in a realistic challenge environment.

The regulation for crew oxygen masks requires that they be donned in 5 seconds. There is no requirement for donning time for the vision protection goggles, though 15 seconds is recommended in the SAE references. Are these times realistic? Should they be tested in a lab at a clear and uncluttered table or should they be tested in the actual configuration as they will be installed in the airplane? We believe the choice is clear that the latter is essential. Further, the test should be done with a realistic challenge smoke. We have not found a safe smoke that simulates the real smoke of combustion of interior materials. However, we believe that the test should be done using a safe but black and acrid smoke, in a simulator representative of the actual installation. The pass/fail criterion must also be specified. We believe that the obvious criterion is the continued safe operation of the airplane.

An important corollary will result from this effort. This will definitely impact the way that crew checklists are designed, as it will show the importance of layout, color and font size.

EMERGENCY TOOLS (CRASH AX)

This project resulted from the unfortunate discovery in the Atlantic Southeast accident with an Embraer EMB-120, ASE flight 529 in Carrollton, Georgia. The crew was provided with a simple roofer's hatchet and attempts to escape the airplane failed as the wooden ax handle broke during the rescue process. Their primary emergency escape path was blocked by fire. Their secondary escape path was the Direct View (DV) windows on the flight deck. These were jammed due to fuselage deformation from the impact sequence.

In our research, we found there was no standard for the required crash ax. ALPA has long held the view that crash axes should have a pry bar feature. In fact, the DV window exit was opened the next day using a pry bar.

A pry bar could also be useful for crews while inflight. Remember that the aircraft is in complete isolation when at altitude. The crew needs a truly useful tool that functions on the particular airplane they are operating, to assist in extinguishing any fire threat before

that threat disables the airplane, since clearly the crew cannot pull over the airplane or bail out.

EMERGENCY EVACUATION ISSUES

There has been significant discussion over the last 7 years on whether emergency evacuation demonstrations should be done. We believe that they should be continued. There are synergies only found in full-scale, such as how the passengers and crew interact with each other and the cabin. The full-scale demonstration provides a baseline evaluation of the flight attendant task assignments, to evaluate their efficiency in directing the passengers toward the doors. Unfortunately, while injuries occur during these demonstrations, the solution is not to stop testing but to identify and improve the equipment reducing not only injuries of the test subjects but more importantly injuries during an actual evacuation.

It is our position that:
1. Full-scale evacuation demonstrations are necessary for newly certified aircraft.
2. Certification authorities should continue to evaluate airplanes using the 90-second rule.
3. Analysis is currently unsatisfactory; but it could have some value for evaluating evacuation performance in smoke, or with handicapped passengers, etc.

Our reasoning for holding these positions is based on the years of discussions we have held in the FAA's ARAC Performance Standards Working Group. To date, we have not been shown that airplane manufacturers can provide a conservative analysis predicting evacuation performance and then run a full-scale demonstration that corroborates the analysis. This is partly due to the high variability in conducting full-scale tests, but it is also probably due to the extremely rudimentary levels of analysis we have been shown to date by the manufacturers. Until the manufacturers can rigorously validate their analytical models we will continue to hold this position. We hope that you will understand the reasoning in this and aid us in holding the manufacturers to this standard.

We welcome further discussions on this to improve the safety of our passengers in survivable post-crash accidents. Eliminating these tests will only delay discovery of significant safety hazards until actual accidents occur, which are far more difficult to document than the presently required tests.

EMERGENCY LOCATOR TRANSMITTERS (ELTS)

Air carrier aircraft are approved to operate in visibilities as low as 300-foot runway visual range (RVR). Unfortunately, airport ATC tower facilities have no means to positively identify when or where an aircraft crashes in such low visibility conditions. The only information available to them is that the aircraft disappears from the radar screens. Numerous accidents confirm this weakness; most recently was American Airlines' B-727 at Chicago O'Hare.

Delays in identifying that an accident has occurred can cause unnecessary loss of life or increase the seriousness of injuries. To maximize survivability of passengers and crew

following an aircraft accident on the airport, a rapid emergency response is necessary. In fact, FAR 139.319(i)(2) requires the first responding units to respond to the midpoint of the furthest air carrier runway within three minutes.

While the FAA now funds airports to equip their rescue vehicles with equipment to traverse the airport rapidly in low visibility conditions (Driver Enhanced Vision System (DEVS)), there is no means in that system to independently determine the accident site location. The infrared vision system provided as part of DEVS will help the rescue personnel locate the accident site once a heat signature is present and the range is not too much, however this is not sufficient in our view.

ELT's were mandated in 1970. According to the preamble of FAR Amendment 91-242, turbojet aircraft were not included in the carriage requirement because they are more readily located after an accident because they operate within the air traffic control system and their operators have filed instrument flight plans.

Accident history has shown that this positive radar coverage is of little benefit in low visibility accidents. As noted, a timely response is essential, yet a timely response cannot be initiated because the task of playing back radar data to determine the last know position of an aircraft is time consuming and requires the skills of ATC specialists who are not always on duty in ATC facilities. Every second counts in the emergency response, and ATC personnel need the tools to alert, confirm and locate an accident within seconds of the accident occurring. Without such tools, the air traffic controller is put in an extremely awkward and stressful position.

Recent Accidents Where An ELT Would Have Helped

Carrier	Location	Complication
AAL	ORD	Fog
Summary: Airplane lands 200 yards short of runway. One aircraft is cleared to land and lands on the same runway unaware of the accident. A second aircraft is cleared to land, and performs a go-around after spotting the crash to the side of the runway. There was no fire. There were no fatalities.		
Carrier	Location	Complication
KAL	Guam	WX
Summary: Airplane hits ridge several miles short of airport. Impact was survivable but fire erupts. First response is in 1 hour. There were only a few survivors by the time the emergency responders arrived. The air traffic controller spent almost 20 minutes trying to determine what had happened to the airplane.		
Carrier	Location	Complication
Air Canada	Fredricton	Snow, Fog
Summary: Airplane stalls during go-around with engines at full power. There was no fire. Some injured occupants could not evacuate the airplane. There were no fatalities. There was no airport radar. The air traffic facility closest to the airport could not confirm the airplane had landed, nor that it had crashed.		
Carrier	Location	Complication
US Air	CLT	Heavy Rain

Summary: Airplane performed a go-around during final approach. Airplane crashed within ½ mile of the airport boundary. The air traffic controller didn't know the airplane was lost on radar.		
Carrier	Location	Complication
Northwest	DTW	Fog
Summary: Airplanes collided on runway in heavy fog. Fire trucks had difficulty in finding airplane on fire.		

We believe that crash-activated ELTs should be installed in all air carrier aircraft. The FAA should also develop ATC radar software that alerts controllers of an accident near the airport. This would serve as a redundant measure to having air carrier aircraft equipped with crash-activated ELTs and all airports with air carrier service equipped with ELT position locating equipment. The ELT systems must have a performance when installed so that an ELT activation can be located within 10 seconds of the ELT being activated.
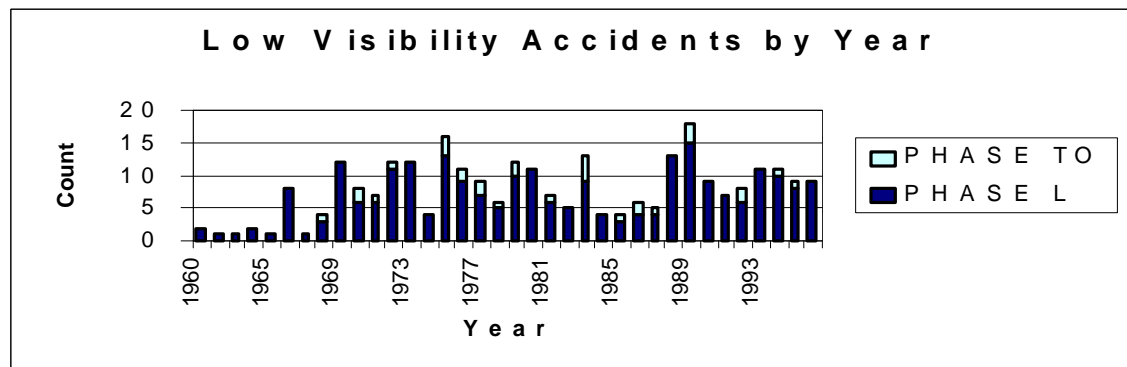
There were 310 accidents on takeoff or landing identified in our worldwide AISL database where low visibility weather was definitely a factor. Of those, 29 specifically were noted as having fires involved, and all but two of these aircraft were destroyed. These accidents span from 1966 to present. A total of 1,277 fatalities in these 29 accidents were documented, which averages out to 40 per year. We should recognize that many of the accidents supporting this statistical sketch may have been caused by actions that have been since reduced as causal factors in accidents, and that the number of fatalities may also be reduced by improvements in cabin safety. But the bottom line is still that Aircraft Rescue Fire Fighters need to know of the accident in order for their fire trucks to get on scene quickly. This will help them have better chances of saving accident victims than if they are impeded from a fast response.

The attached chart displays the number of accidents that occurred each year. The lack of any decline in the total number of accidents suggests that these accidents in takeoff and landing are not being reduced by safety improvements.

ARFF: ONE LEVEL OF SAFETY
The B1900 accident at Quincy, Illinois showed that providing rescue and fire fighting is essential to occupant safety, and that fire fighting must be rapid in responding. A slow

response (14 minutes in Quincy) is ineffective. Quincy confirmed the high risk to occupants of an aircraft exposed to fire: high-density seating, large fuel quantity in close proximity to high energy parts, a fragile barrier for post-crash fire.

Improvements must be made in Aircraft Rescue and Fire Fighting to provide passengers and crews with the protection necessary in the event they are endangered. Regulatory requirements are minimal, and have no real standard for the number of rescue personnel required. ALPA records have shown that more extinguishing agent is in used actual accidents.

The basic hypothesis for provision of quantity of agent is that an area the length of the aircraft and 50 feet on both sides must be covered in agent in the first minute, and then there must be additional agent to maintain a clear escape path. This area is referred to as the TCA. Thus, the agent quantity is proportionate to the size of the aircraft (bigger airplane leads to bigger fire). However, through the negotiating process, the Theoretical Critical Fire Area (TCA) has been reduced by one third to the Practical Critical Fire Area (PCA). This is unjustified based on the historical accident data. Much more agent has been required in actual aircraft accident fires than required by the PCA calculation.
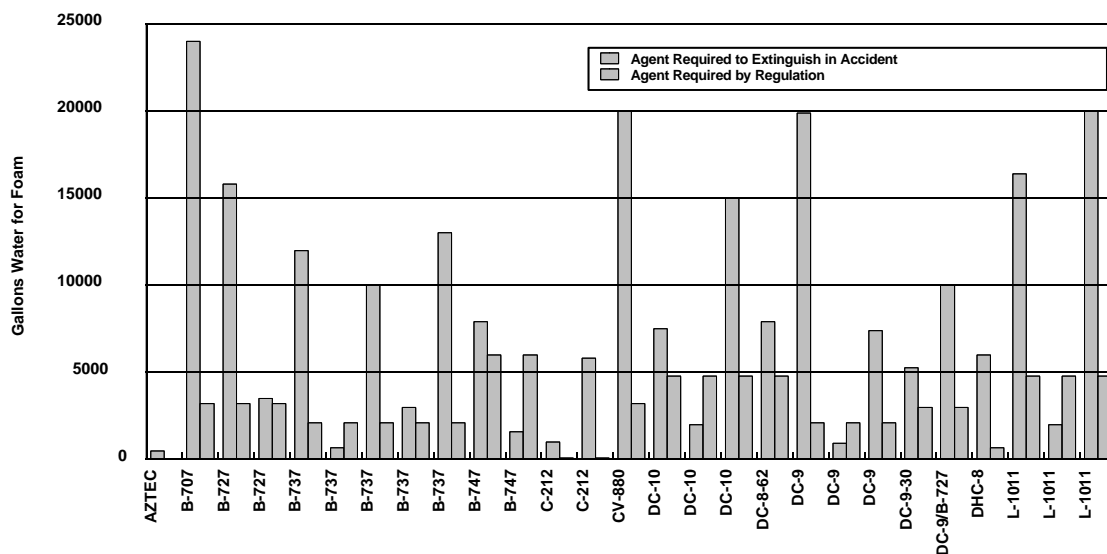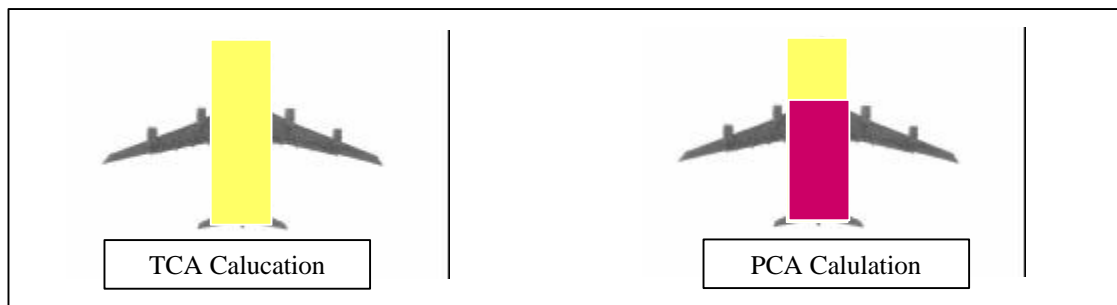
TCA Calucation

PCA Calulation

Some important corollaries result from the determination of agent quantity. The number of trucks and the number of fire fighters increases as aircraft size increases. This makes sense, but thus far there is no requirement for any set number of rescue personnel for a certain size airplane, as there is for flight attendants of 1 for every 50 seats in the airplane cabin.

Subsequent to the Quincy accident the NTSB issued recommendation A-97-107 that recommended that the FAA

> "Develop ways to fund airports that are served by scheduled passenger operations on aircraft having 10 or more passenger seats, and require these airports to ensure that aircraft rescue and fire fighting units with trained personnel are available during commuter flight operations and are capabile of timely response."

The Part 139 section of the Federal Aviation Regulations specifically excludes the airports serving only aircraft with seating capacity of 30 passengers or less. This scope was set by Congress in the original mandate for the regulations on airport certification. We oppose this criterion, as it clearly puts those passengers at risk. But worst of all, the passengers on these airplanes are *unknowingly* put at risk. In another NTSB recommendation from the Quincy accident (A-97-108), the NTSB recommended that the FAA publish a list of the airports with commercial service and no Rescue and Fire Fighting. The FAA opposed taking action in this regard, stating that they were not able to collect such data. We support this recommendation and urge that the FAA require airlines to inform their passengers when they will be on flights that are not provided with fire protection.

ARFF: Canada

Throughout Canada only 28 airports are required to have adequate RFF, and only 15 are protected 24 hours a day. Canada has opted to use a risk analysis method for what airports are provided Rescue and Fire Fighting service. Their criteria for provision of RFF in Canada was only that about 90% of all air carrier aircraft operations need to have RFF coverage. This is fine if only the operations in that 90% have an accident, however that is not how accidents happen. Just as the need for RFF should not be linked to the size of aircraft, it should not be linked to the frequency of the operations.

Canada allows infrequent operations of even very large aircraft with absolutely no RFF on scene. They only set standards for RFF relative to the aircraft size if the airplane operates into the list of 28 airports.

We have a significant interest in being provided fire protection for all operations. We also understand the unique nature of flight operations in Canada. Some flights may be the only manner of transportation to some locales, and they may be very infrequent, such as once a week. However, this does not mean that passengers and crew on those flights should not be provided a reasonable level of protection. These flight operations should be

provided rescue and fire fighting service for the time when the aircraft will be at the airport. It does not demand that a 24-hour fire station be provided. The service provided *needs to be prepared* with equipment to enable the service to respond in a rapid manner to the probable accident sites for that airport. This may necessitate more than one fire station, or special vehicles that are capable of traversing the terrain at the airport while flight operations occur.

We conclude that safety is most important and that it can be maintained even for the infrequent and remote operations by appropriate planning. We simply need all parties to show the commitment to make it happen.

ARFF: ETOPS
Rescue and Fire Fighting needs to be provided at airports designated as ETOPS alternates, and it must be of sufficient size for the aircraft. There is action underway to set the standard for RFF at the required alternate airports at an absurdly low level. The only protection required would be one vehicle with one fire fighter, where the vehicle carries 500 lb. of Halon and 100 gallons of water for foam agent. This is a Category 4 level of protection in the ICAO standards.

While providing Category 4 service may be useful in some limited fire scenarios, it is not sufficient for the potential fire areas for current ETOPS aircraft. It is our view that the scenarios that an ETOPS aircraft could expect to experience for a reason to divert to their alternate are in fact not unique to their 2-engine arrangement. We believe that all long-range aircraft should designate critical alternate airports that have adequate RFF as well as other related facilities that may be needed, such as medical facilities and shelter.

Conclusion
The crew has the expertise on the operation of an airplane on a day to day basis. We are at the controls in the center of these factors affecting safety on the airplane. Our passengers are at the center as well, impacted by the influences on safety. They depend on us for getting the airplane down safely in light of the multitude of hazards that may present themselves while inflight. The hazards cannot be eliminated, but crew must be provided adequate means of knowing and dealing with the hazards to maximize the safety of the flight.